Emcee Electronics, Inc.
520 Cypress Avenue * Venice, Florida 34285

EMCEE

DIGITAL

CONDUCTIVITY

METER

convenient
reliable
accurate
measurement
of
electrical
conductivity

EMCEE Model 1152 DIGITAL CONDUCTIVITY METER

(ASTM Standard Test Method D 2624)

- Continuous standard electrical conductivity range from 0 to 1999 in increments of 1 picosiemen per meter (pS/m)
- Available in other standard and non-standard conductivity ranges
- Large digital, liquid crystal display
- Reliable advanced integrated circuit design technology
- Self check calibration with field adjustment capability
- Automatic over range and low battery indication
- Capable of storage tank and tanker truck measurement with the use of a short cable or cable reel kit
- Powered by 3 readily available alkaline batteries
- Electronics housed in a rugged cast aluminum case coated with solvent resistant paint equipped with a detachable stainless steel probe
- Approved intrinsically safe design for use in hazardous environments by Underwriters Laboratories (UL) U.S, (UL) Canada and LCIE (Europe)

Model 1152 Meter

Cable Reel Kit

Detachable Probe

APPLICATIONS

The Model 1152 Digital Conductivity meter provides a measurement of electrical conductivity of fluids in conductivity units (CU), which are defined as picosiemens per meter in ASTM D 2624. The rugged Electro/mechanical design of the Model 1152 meter facilitates ease of use for both laboratory and field applications. Initially the meter was designed and developed for safety reasons to measure the electrical conductivity of hydrocarbon fuels, particularly jet fuels. Subsequently, The meter was modified with other conductivity ranges to accommodate measurement of a variety of fluids for use in many different applications.

Safety – Hydrocarbon fuels typically have low electrical conductivity and consequently, are susceptible to retaining a static charge. Static charges are induced, especially, when the fuel is pumped at high rates through filters. Due to the relatively low conductivity, the static charge does not readily dissipate and is retained for a considerable period of time. This condition can result in an explosion and/or fire. Since conductivity is a function of temperature, it is very important to record the fuel temperature at which the measurement was performed.

Process Controls – In addition to safety reasons, electrical conductivity of fluids can be monitored for process control. Proper addition and mixing of various ingredients can be monitored at different stages of production. These applications are not limited to hydrocarbons, but have been expanded to other products; such as paints, solvents, inks, and other non-organic items. The stainless steel probe is relatively unaffected by most acidic and caustic solutions.

Specifications:

Range:	0 – 1999 pS/m
Resolution:	1 pS/m
Accuracy:	2% of reading ± 1 pS/m
Over-Range Indicator:	"1" on left side of display
Calibration:	Internal source, field adj.
Controls:	2 Pushbuttons, "M" (measure) & "C" (calibration)
Display:	Liquid crystal, 3 ½ digits, ½ inch (.27 cm) high
Safety Ground:	Banana jack on electronics assy.
Power:	Battery, 3 each, 6 volt alkaline
Op Temp Range:	32° to 165° F (0° to 75° C)
Carrying Case:	Hard, solvent resistant, molded plastic

Theory of Operation – The EMCEE Model 1152 meter consists of an electronics assembly and a detachable stainless steel probe. The probe, which is similar to a capacitor having concentric electrodes, is immersed into the fluid, up to the set of holes closet to the electronics assembly. Depressing the "M" pushbutton causes a relatively small direct current to flow through the fluid between the electrodes. The current is amplified in the electronics assembly and is displayed on the liquid crystal display in picosiemens per meter (pS/m).

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DIGITAL CONDUCTIVITY METER SERVICE MANUAL

MODEL 1152 SERVICE MANUAL

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DIGITAL CONDUCTIVITY METER SERVICE MANUAL

1.0 GENERAL DESCRIPTION

1.1 The Emcee Digital Conductivity Meter model 1152 as shown in Figure 1 is a hand held, battery operated, instrument for determining the conductivity of fuel samples. Technically, the instrument is a high range ohmmeter capable of reading between 500 megohms (2000 CU) and infinity (0 CU).

1.2 The controls as shown in Figure 1 consist of a pushbutton switch marked M (measure) and a pushbutton switch marked C (calibrate).

1.3 Figure 2 shows the instrument with the probe attached and ready for fuel test.

1.4 Figure 6 shows the instrument in operation with the probe in a fuel sample.

1.5 The Accessory Cable Kit is shown in Figure 7 and 8. With this reel the instrument can be used to test fuel in a large storage tank.

1.6 Figure 10 shows the instrument with the back removed, and the plug in pre-amp and analog to digital PC boards removed.

1.7 Figure 11 shows the CU Substitution Box for complete calibration.

2.0 TEST EQUIPMENT REQUIREMENTS

2.1 CU Substitution Box

2.2 Digital Voltmeter, 10 megohm impedance 0-1 volt +/- .001 0-20 volt +/- .01.

3.0 PRELIMINARY CALIBRATION CHECK

3.1 Attach probe to bottom connector on the conductivity meter.

3.2 Depress measure switch (marked M). The display should indicate 000 +/- 001 after 3 seconds. If the display does not indicate 000 +/- 001 remove the probe and recheck for zero. If the meter will zero without the probe but not with the probe, the probe should be rinsed with isopropyl alcohol and allowed to air dry before retesting. If the meter will not zero without probe, proceed to calibration procedure.

3.3 Depress calibration switch (marked C). The display should indicate the number on the probe (Figure 3) times 10 +/- 005.

Example: Probe No. = 42
Display = 415 - 425

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4.0 BATTERY REPLACEMENT

4.1 The model 1152 Conductivity Meter has an internal battery checking circuit. If batteries are weak the meter will read for a short time and shut itself off. If batteries are very low the unit will not turn on.

4.2 When battery replacement is indicated remove the 4 screws holding the back plate exposing the battery housing at the top of the meter.

4.3 Remove the 2 screws on the battery housing and set housing cover to one side (Figure 10).

4.4 Observe the polarity markings and insert three new batteries as shown in Figure 10. Battery replacement must be (3) 6 volt Alkaline Nema 1414A Emcee P/N 152-90-5341. Any other battery replacement will invalidate the CSA and UL Intrinsically Safe Rating.

4.5 Replace back panel, check zero and calibration.

5.0 CIRCUIT DESCRIPTION

5.1 Power Supply The model 1152 Digital Conductivity Meter uses (3) A-554 6 volt batteries as a single 18 volt power source. Depressing either the measure or calibrate switches provides power to op amp 1 via D(1) or D(2). Op amp 1A compares the battery voltage to a positive output at 6 volt zener reference (ZD-1) and provides a positive output at pin 1 if the battery voltage is above 13 volts. This insures adequate voltage for good regulation via VR-1. VR-1 provides a +10 volt (pin 1) and a +5 volt (pin 2) output in reference to pin 4. The +5 volt (pin 2) output in reference to pin 4. The +5 volt output is buffered with op amp 1B. The 0 level reference voltage is developed using the output on op amp 1B pin 7. From this reference point we now have a +5 volt source and a -5 volt source.

The 0 reference voltage is not attached to the case. Resistors R-15 and R-16 make up a voltage divider to provide a -1 volt source which is tied to the case. The -1 volt becomes the bias voltage for the fuel probe.

5.2 CALIBRATE REFERENCE - The calibrate voltage is supplied by Q-1 and is adjustable from 0 to -1 volt. Q-1 is biased on in a saturation mode via R-14 when the calibrate switch is depressed. The collector output is divided by R-21 and R-20 and the adjustable voltage is passed on to the pre-amp. When the measure switch is depressed R-13 reverse biases Q-1 and turns Q-1 off. This action guarantees a 0 volt potential to the pre-amp calibrate input.

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5.3 Pre-Amp PC Board - P/N 152-04-0000 The pre-amp board is a separate plug-in PC board. Due to the extreme high impedance of the circuit, this board is very sensitive to humidity. After manufacture, this board is coated with a conformal coating to reduce outside humidity effects. Since this coating cannot be removed, the components on this board should not be replaced. Any failure of the pre-amp board requires a new board assembly. The operation of this board, however, is to develop a current from the -1 volt bias through the fuel sample to the op amp pin 2. Pin 2 is maintained at 0 volts via the positive feedback through R3. With no fuel between the probe electrodes the pre-amp output should be zero. This is adjusted with zero adjust potentiometer R-19. During the calibrate period the negative voltage from R-20 provides the bias source to the pre-amp and a calibrate reference can be set.

5.4 A-D Converter PC Board - P/N 152-05-0000 The A-D converter assembly is a plug-in PC board. The converter is basically a 0 - 1.999 volt., 3 digit voltmeter. The reference voltage for setting the A-D gain is adjusted by setting R-18 for approximately 1.0 volts. The final adjustment for this potentiometer, however, is dependent on R-3 tolerance and variations in the probe constant. The pre-amp output is fed to the A-D converter which has an automatic zero adjustment, therefore, any output from the amp can be directly monitored. The A-D converter directly drives the liquid crystal display located on the display PC board. The A-D board can be factory repaired.

5.5 Display PC Board P/N 152-03-0000 The display board includes the power regulator, reference voltage supply, calibration adjustment controls, liquid crystal display, measure and calibrate switches, and the interconnects for the A-D and the pre-amp boards. The display board can be factory repaired.

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6.0 TROUBLE SHOOTING CHART

MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
Meter does not zero	Contaminated Probe	Clean thoroughly with isopropyl alcohol and air dry
	Needs zero adjustment	Adjust zero as per 7.2.
Meter reads above or below calibration number during CAL check	Needs CAL adjustment	Check Pre-amp output as per 7.0
CU reading erroneous when CAL check is okay	Contaminated or damaged probe.	Clean probe with isopropyl alcohol and air dry
		Inspect probe for physical damage.
		Check electrical characteristics as per 7.0
No Display Indication	Lack of supply voltage	Check connection and/or replace batteries
	MEASURE/CAL switch defective	Replace Display PC Bd. P/N 152-03-0000
	A-D Converter defective	Replace A-D PC Bd. P/N 152-05-0000
	+/- 5 Supply In-op	Replace Display PC Bd. P/N 152-03-0000

7.0 CALIBRATION

7.1 With the back panel removed set R-18 (case hole marked CAL) to approximately mid scale. The exact setting is not important at this time, however, the voltage at A-15 should be approximately 1.0 volts above the zero reference (A-14).

7.2 Remove the probe if attached and depress the measure switch (M). Adjust R-19 (case hole marked ZERO) for a display of 000 +/- 1.

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7.3 Attach the CU substitution box directly to the conductivity meter using the 500 CU position.

7.4 Depress the measure switch (M) and adjust R-18 (CAL) for a display reading of 500 +/- 1.

7.5 Remove the substitution box and repeat the zero adjustment (7.2) if necessary. If zero adjustment is necessary repeat 7.3 and 7.4 after readjusting zero.

7.6 Attach the CU substitution box to the conductivity meter using the 100 CU position.

7.7 Depress the measure switch (M) and read the display for linearity. The display should read 100 +/- 1. If the display is outside of tolerance recheck zero and 500 CU positions.

7.8 Remove the plug from the unmarked hole in the case (between the ZERO and CAL holes) to access R-20 (CAL reference).

7.9 Depress the calibrate switch (C) and adjust R-20 (Cal reference voltage) for a display or 400 +/- 1.

7.10 Replace the plug removed in step 7.8 (no additional adjustment of R-20 is necessary).

7.11 The instrument is now electrically standardized and should read ZERO = 000 +/- 001, CAL = 400 +/- 001, 500 CU BOX = 500 +/- 001 and 100 CU BOX = 100 +/- 001.

7.12 The meter is then adjusted to the probe for proper fuel measurements. Identify the probe constant by locating the number stamped on the probe (Fig. 3). Multiply that number by 10 and adjust R-18 (CAL) for that number.

Example: Probe No. = 42 x 10 = 420

CAL adjust to 420 +/- 001

7.13 The meter is now properly calibrated for fuel measurements. Refer to section 8.0 for operating procedure.

8.0 TEST PROCEDURE

8.1 Attach probe to bottom connector on the conductivity meter.

8.2 Depress measure switch (M) with probe OUT of fuel sample. Reading should be 000 +/- 001 in approximately 3 seconds (Figure 4). If reading is outside limits remove probe and recheck zero by depressing measure switch.

8.2.2 If zero reading is outside of limits with probe removed, perform calibration procedure outline in section 7.0.

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8.3 Depress Calibrate switch (C) with probe OUT of fuel sample. After 3 seconds reading should be 10 times the probe calibration number +/- 005 (Figure 5).

Example: Probe No. = 40

Meter Reading = 400 +/- 5 or 395 to 405

8.4 Insert probe in fuel to upper holes and depress measure switch. Report reading after 3 seconds for stabilization. Due to the polarization of the fuel sample the apparent reading will continue to change. Only the reading 3 seconds after depressing the measure switch is correct.

9.0 PARTS LIST

Batteries (3 required)	152-90-5341
Display PC Board	152-03-0000
Pre-Amp PC Board	152-04-0000
A-D Converter PC Board	152-05-0000
Probe	152-09-0000

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DIGITAL CONDUCTIVITY METER SERVICE MANUAL

Figure 1

Figure 2

Figure 3

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Figure 4

Figure 5

Figure 6

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Figure 7

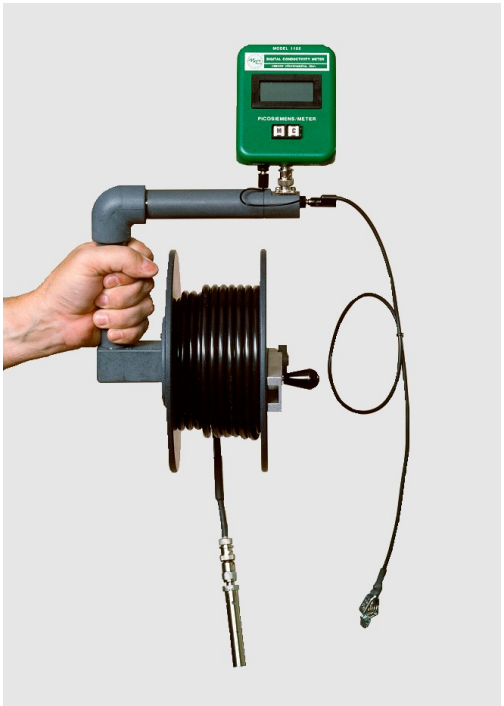

Figure 8

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DIGITAL CONDUCTIVITY METER SERVICE MANUAL

Figure 9

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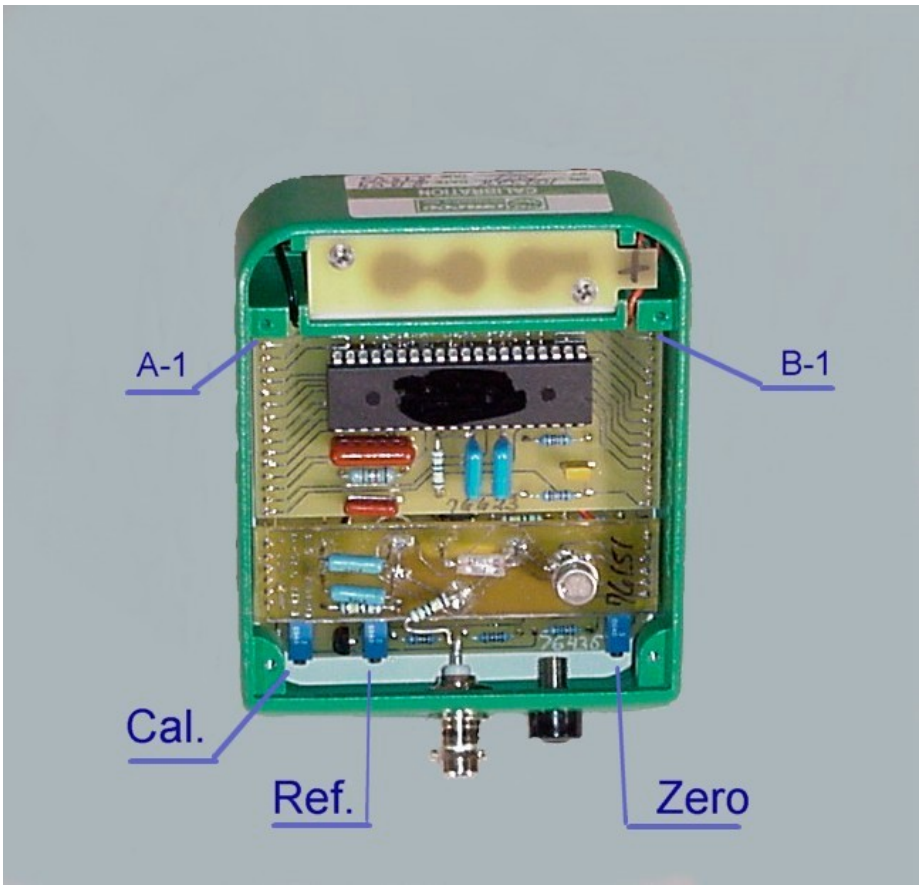

Figure 10

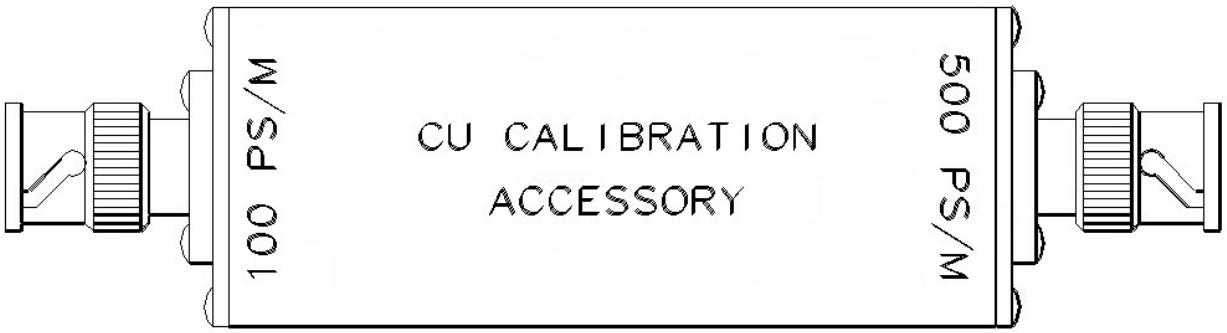

Figure 11

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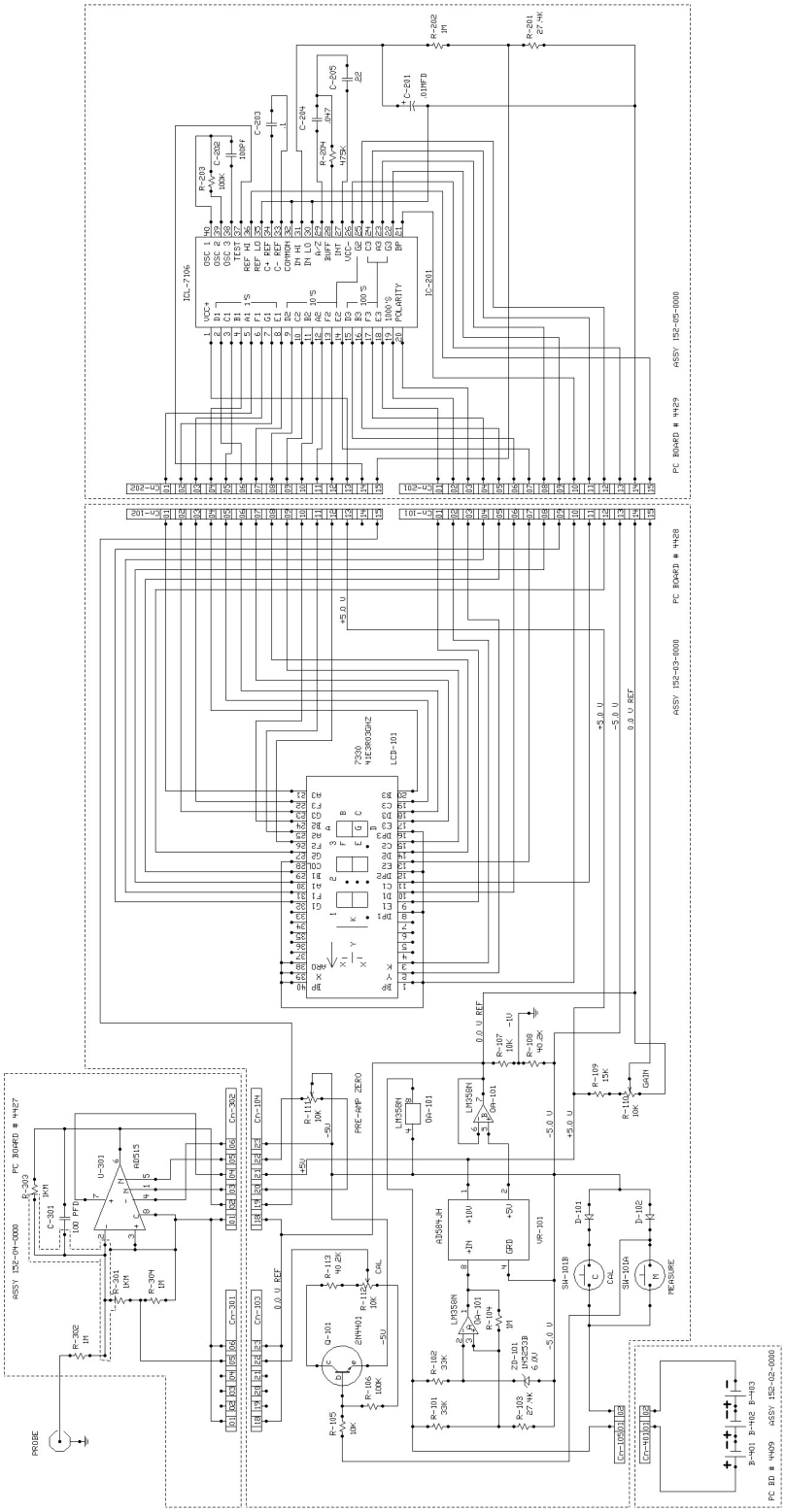

Figure 12

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DIGITAL CONDUCTIVITY METER
MODEL 1152 OPERATION MANUAL

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Service & Warranty Policy

See Emcee Electronics, Inc Service and Warranty Manual

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DIGITAL CONDUCTIVITY METER

1.0 SCOPE

The Emcee Conductivity Meter is a reliable, convenient and inexpensive instrument for measuring the electrical conductivity of fuels. The monitor incorporates all solid-state components and is completely self-contained. Several instruments are available for various ranges.

Model	Multiplier	Range
152-00-0000	X 1	0 – 2,000 pS/m
152-00-0001	X 10	0 – 20,000 pS/m
152-00-0003	X 100	0 – 200,000 pS/m
152-00-0007	X 1,000	0 – 2,000,000 pS/m
152-00-0008	X 10,000	0 – 20,000,000 pS/m

The instrument will display units between 0 and 1999. The conductivity is equal to the reading times the instrument multiplier and is reported in picosiemens/meter (pS/m). The instrument has a simple calibration and zero check; and indicates when the conductivity level exceeds the upper range of the meter by displaying 1--- on the LCD display.

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DIGITAL CONDUCTIVITY METER

2.0 SIGNIFICANCE

Fuel products such as jet and diesel fuels which are loaded at high pumping rates, develop a static charge. The Emcee Conductivity Meter measures the ability of the fuel to dissipate that charge.

3.0 DEFINITION

The Emcee Conductivity Meter reads conductivity in picosiemens/meter which are equivalent to CU or Conductivity Units.

4.0 SUMMARY OF METHOD

The Emcee Conductivity Meter uses a probe consisting of two concentric stainless steel electrodes. When the probe is immersed in fuel, a constant voltage is applied to the electrodes. This results in an electrical current which is amplified and indicated on the meter.

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DIGITAL CONDUCTIVITY METER

5.0 APPARATUS

5.1 The Emcee Conductivity Meter with Fuel Probe is shown in Figure 1. The meter is a hand held, battery operated portable instrument.

5.2 The controls shown in Figure 1 consist of a measure switch and a calibrate switch.

5.3 Figure 2 shows the location of the probe calibration number.

5.4 Figure 3 shows the instrument zero check.

5.5 Figure 4 shows the instrument calibration check.

5.6 Figure 5 shows a typical fuel test.

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5.7 The Accessory Cable Kit shown in Figure 6 includes a portable reel with a 50' cable . This kit enables the operator to connect the probe to the 50' cable for use in a large tank. The kit also is supplied with a grounding cable for attachment between the conductivity meter and tank ground.

6.0 PREPARATION OF SAMPLE

The sample container (preferably a one liter metal container) should be cleaned with a solvent and rinsed with the fuel to be tested. After the sample for test has been withdrawn, wait approximately two minutes for charges in the fuel to dissipate.

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7.0 TEST PROCEDURE

7.1 Attach probe to bottom connector on conductivity meter.

7.2 Depress MEASURE switch (M) with probe OUT of fuel sample. Reading should be 000 +/- 001 in approximately 3 seconds (Figure 4). If reading is outside limits, remove probe and recheck zero by depressing MEASURE switch.

7.2.1 If zero adjustment is okay without probe but not when probe is attached, the probe should be thoroughly rinsed with isopropyl alcohol followed by reagent grade toluene and allowed to air dry before retesting for zero.

7.2.2 If the reading is outside of limits with the probe removed, perform calibration procedure outline in Section 10.0.

7.3 Depress CALIBRATE switch (C) with probe OUT of fuel sample. After 3 seconds, reading should be 10 times the probe calibration number +/- 005 (Figure 4).

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SAMPLE

Probe No. = 40
Meter Reading = 400 +/- 5 or 395 to 405

7.4 Insert probe in fuel to upper holes and depress MEASURE switch. Report displayed reading times multiplier after 3 seconds for stabilization. (Due to the polarization of the fuel sample the apparent reading will continue to change. Only the reading 3 seconds after depressing the MEASURE switch is correct).

Note: If a "1" is displayed on the left side of the display, the conductivity level exceeds the upper range of the meter.

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DIGITAL CONDUCTIVITY METER

8.0 PRECISION

The electrical parameters are factory calibrated to 1% of reading. However, due to fuel measurement characteristics, the repeatability and reproducibility limits are as follows:

PS/M	REPEATABILITY	REPRODUCIBILITY
50	4	12
100	6	18
150	8	23
200	9	27
250	10	30
300	11	34
400	5%	10%

Limits Applicable at Room Temperature only.

Precision based on ASTM Round Robin test of standard 0 - 2,000 pS/m meter.

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9.0 BATTERY REPLACEMENT

9.1 The Model 1152 Conductivity has an internal battery checking circuit. If batteries are weak the meter will read for a short time and shut itself off. If batteries are too low the unit will not turn on.

9.2 When battery replacement is indicated remove the 4 screws holding the back plate exposing the battery housing at the top of the meter.

9.3 Remove the 2 screws on the battery housing and set the housing cover to one side (Figure 7).

9.4 Observe the polarity markings and insert three new batteries as shown in Fig. 7. Battery replacement must be (3) 6 volt Alkaline Neda 1414A (A-544). Any other battery replacement will invalidate the Intrinsically Safe Rating.

9.5 Replace back panel and check zero and calibration.

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10.0 CALIBRATION

10.1 If either ZERO or CALIBRATE is outside the limits listed in 7.2 or 7.3 the following steps should be completed.

10.2 Remove the probe.

10.3 Insert a small screwdriver into the hole marked ZERO while depressing the MEASURE switch. Adjust the control until the display reads 000 +/- 001.

10.4 While depressing the CALIBRATE switch, insert a small screwdriver into the CALIBRATE hole and adjust for 10 times the probe calibration number +/- 002.

10.5 Attach the probe and depress the MEASURE switch. The reading should be 000 +/- 001. If zero adjustment is okay without probe but not when probe is attached the probe should be thoroughly rinsed with isopropyl alcohol followed by reagent grade toluene and allowed to air dry before retesting for zero.

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